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(54) Multiplex transmission apparatus

Multiplexübertragungsvorrichtung

Dispositif de communication de données en multiplex

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(56) References cited:
EP-A- 0 281 376
EP-A- 0 451 825
JP-A- 3 283 844
JP-A- 63 148 739
US-A- 4 825 362
US-A- 5 343 472

- **VEHICLE ELECTRONICS IN THE 90"S :PROCEEDINGS OF THE INTERNATIONAL CONGRESS ON TRANSPORTATION ELECTRONICS, October 1990, WARRENDALE pages 463 - 471, XP000223558 SCHMIDT ET AL. 'REQUIRED ELEMENTS OF INTEGRATED VEHICLE CONTROL SYSTEMS'**
- **Koch, G.; Rembold, U.; Ehlers, L.: "Einführung in die Informatik", Teil 2. Programmsysteme, Anwendungen und technologische Perspektiven; Carl Hanser Verlag, München, Wien; 1980; pages 280-313**
- **SAE-Paper Series: "Advances in Multiplexing in Automobiles", SP-806; SAE-Paper 900704; Miyake, K.; Kawakatsu, S.: "A Multiplexed Body Wiring System for Practical Use"; Society of Automotive Engineers, Inc.; 400 Commonwealth Drive; Warrendale, PA 15096-0001; February 1990; pages 89-98**

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a multiplex transmission apparatus which comprises a plurality of nodes connected to communication lines for transmission and reception of various kinds of control information in a multiplexed fashion, to/from the communication lines.

[0002] EP 0 281 376 A2 describes a multiplex control system comprising a four-wire bus B connecting two control units. The control units control load devices situated on their respective sides of the vehicle via wiring harnesses in multiplexed or parallel node. The control unit is arranged to transmit a pulse train along the bus and each input element such as a control switch includes a circuit arranged to count the pulses and modify certain pulse if the input element is in a predetermined condition, wherein the control unit is further arranged to detect any such pulse modification and to identify the corresponding input element.

[0003] From EP 0 451 825 A1 multi-transmission method and multi-transmission system for vehicle is known. This system includes first multi-transmission terminals equipped in the doors of the vehicle and second type multi-transmission terminals equipped in the vehicle compartment. The first type multi-transmission terminals operate based on the low speed data transmission protocol and a second type multi-transmission terminals convert the protocol between the low speed data transmission protocol and high speed data transmission protocol. A high speed bus line is used between the first and second type multi-transmission terminals, and a low speed bus line is used between the second type multi-transmission terminals.

[0004] Recent development of electrical components for vehicles and electronic control to such components have brought an enormous increase of wiring, connectors and control devices arranged in a vehicle body, making wire harness attached to the vehicle body larger in size and heavier in weight. The growth of wire harness limits attaching space in the vehicle body and degraded flexibility of wire harness lowers attaching efficiency. Besides, the overweight of wire harness is directly related to overweight of the vehicle body.

[0005] For the purpose of decreasing the number of wiring, connectors and control devices, Japanese Patent Application Laid-Open No. 63-148739 proposes a multiplex transmission system for vehicles which comprises a common communication line for multiplex transmission of plural kinds of control information to operate various electrical components, connectors and control devices in vehicles. The common communication line is connected to a plurality of nodes which perform transfer and reception of control information to/from the line, and various electrical components are appropriately connected to the nodes.

[0006] In this multiplex transmission system, the communication line for transmission of multiplexed control information comprises a signal transmission path formed with wire harness arranged in a vehicle body. The plurality of nodes connected to the communication line are respectively combined with actuators including motors arranged at each and signal generating devices such as sensors and switches. The respective nodes receive selected control information from the communication line and generate a control signal based on the received control information. The nodes supply the control signal to the actuator to perform an operation control, or generate control information based on a signal from the signal generating device and transmit the information to the communication line. The multiplexed control information transmitted through the communication line is expressed by e.g. a pulse code modulation (PCM) signal in the form of non-return-to-zero (NRZ) modulated carrier wave signal.

[0007] In the above mentioned multiplex transmission system, upon forming a control signal based on control information from the communication line or upon forming control information based on a signal from the signal generating device, the actuator and the signal generating device usually require operation process in accordance with control information from the communication line or the signal from the signal generating device by an operation control unit comprising e.g. a microcomputer. The respective nodes include a transceiver connected to the communication line, an operation control unit connected to the transceiver, comprising e.g. a microcomputer and an input-output processor connected to the operation control unit and either of the actuator or the signal generating device.

[0008] The actuators and the signal generating devices which require operation process in the nodes are normally arranged in a vehicle body in a decentralized manner. In the conventional multiplex transmission system, an actuator or a signal generating device which requires operation process are included in almost all the nodes. For this reason, the nodes necessarily include both an operation control unit and an input-output processor. However, the system comprising nodes of this type possesses a problem in lowering cost efficiency.

SUMMARY OF THE INVENTION

[0009] The present invention has as its object to provide a multiplex transmission apparatus in which a plurality of nodes on multiplex transmission lines are arranged so that the entire structure of the apparatus can be simplified and costs of the apparatus can be reduced.

[0010] According to the present invention, the foregoing object can be attained by providing a multiplex transmission apparatus as claimed in claim 1. Further advantageous embodiments are defined in the dependent claims. The apparatus comprises a plurality of control nodes connected to common multiplex transmission

paths in a decentralized manner. The nodes are classified into a plurality of types corresponding to control functions, comprising communication control means for realizing communication function based on the types in the respective plurality of control nodes and operation control means for performing a predetermined operation process in specific control nodes among the plurality of control nodes. The communication control means controls signal communication between the multiplex transmission paths and the operation control means.

[0011] Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

Fig. 1 is a block diagram showing the configuration of a multiplex transmission apparatus according to an embodiment of the present invention;
Fig. 2 is a block diagram showing the configuration of a node of low-speed non-operation control type according to the embodiment;
Fig. 3 is a block diagram showing the configuration of a node of low-speed operation control type according to the embodiment;
Fig. 4 is a block diagram showing the configuration of a node of high-speed operation control type according to the embodiment; and
Fig. 5 is a diagram showing the frame structure of control information in the embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Preferred embodiments of the present invention will be described in detail in accordance with the accompanying drawings.

[0014] Fig. 1 shows the configuration of a multiplex transmission apparatus according to an embodiment of the present invention which is applied to a vehicle body.

[0015] In Fig. 1, two types of multiplex transmission line systems comprising communication lines expressed by a full line and a broken line are formed in a vehicle body expressed by an alternate long and short dash line. The communication line (the full line) is a high-speed communication line 11 employing a twisted-pair shielded line, and the other communication line (the broken line) is a low-speed communication line 12 employing a twisted-pair line. The high-speed communication line 11 and the low-speed communication line 12 are arranged inside of the vehicle body, and a plurality of nodes arranged at respective parts of the vehicle body are connected to the communication lines.

[0016] The nodes include a front right node 13, a column node 14, a meter node 15 and an engine node 16 connected to both the high-speed communication line 11 and the low-speed communication line 12, a main-fuse node 17, an anti skid brake system (ABS) node 18, a cowl right-side node 19, a rear left node 20 and a rear right node 21 connected to the high-speed communication line 11, a front left node 22, an instrument panel node 23, a cowl left-side node 24, a center consol node 25, an audio system node 26, a front left door node 27, a rear left door node 28, a front right door node 29, a rear right door node 30 and a tail node 31 connected to the low-speed communication line 12.

[0017] These plurality of nodes are connected to actuators including motors and groups of signal generating devices such as various sensors and switches (not shown in Fig. 1).

[0018] Among these plurality of nodes, the nodes connected to the high-speed communication line 11 respectively receive selected control information from the high-speed communication line 11 as received control information then generate a control signal based on the received control information, and supply the signal to an actuator for control of the actuator, otherwise, generate control information based on a signal from a signal generating device and send the information as transmission control information to the high-speed communication line 11.

[0019] Similarly, the nodes connected to the low-speed communication line 12 among the plurality of the nodes respectively receive selected control information from the low-speed communication line 12 as received control information then generate a control signal based on the received control information, and supply the signals to an actuator for control of the actuator, otherwise, generate control information based on a signal from a signal generating device and send the control information as transmission control information to the low-speed communication line 12.

[0020] It should be noted that the front right node 13, the column node 14, the meter node 15 and the engine node 16 connected to both the high-speed communication line 11 and the low-speed communication line 12 perform transmission of control information between the high-speed communication line 11 and transmission of control information between the low-speed communication line 12.

[0021] Among the plurality of nodes, in the center console node 25, the audio system node 26, the front left door node 27, the rear left door node 28, the front right door node 29, the rear right door node 30 and the tail node 31, upon generating a control signal based on received control information inputted from the low-speed communication line 12, an actuator does not require operation process by an operation control unit comprising

e.g. a microcomputer.

[0022] Accordingly, the center console node 25, the audio system node 26, the front left door node 27, the rear left door node 28, the front right door node 29, the rear right door node 30 and the rail node 31 correspond to a node 43 as shown in Fig. 2. Node 43, which is a low-speed non-operation control type node, includes a transceiver 41 and an input-output processor 42 connected to the transceiver 41 and does not include an operation control unit. The input-output processor 42 is connected to an actuator 44 and a switch 45 which forms a signal generating device.

[0023] In contrast, in the front right node 13, the column node 14, the meter node 15, the engine node 16, the main-fuse node 17, the ABS node 18, the cowl right-side node 19, the rear left node 20, the rear right node 21, the front left node 22, the instrument panel node 23 and the cowl left-side node 24, upon generating a control signal based on received control information inputted from the high-speed communication line 11 or the low-speed communication line 12, an actuator requires operation process by an operation control unit comprising e.g. a microcomputer, further, upon forming transmission control information based on a signal from a signal generating device, the signal generating device requires operation process.

[0024] The front left node 22, the instrument panel node 23 and the cowl left side node 24 connected to the low-speed communication line 12 among the front right node 13, the column node 14, the meter node 15, the engine node 16, the main fuse node 17, the ABS node 18, the cowl right-side node 19, the rear left node 20, the rear right node 21, the front left node 22, the instrument panel node 23 and the cowl left-side node 24 correspond to a node 48 as shown in Fig. 3. Node 48 which is a low-speed operation control type includes a control unit 46, which is connected to the low-speed communication line 12, comprising a microcomputer having a transmission/reception function and operation processing function and an input-output processor 47 connected to the control unit 46. The input-output processor 47 is connected to an actuator 49 and a sensor 50 which forms a signal generating device.

[0025] The the main-fuse node 17, the ABS node 18, the cowl right-side node 19, the rear left node 20 and the rear right node 21 connected to the high-speed communication line 11 among the front right node 13, the column node 14, the meter node 15, the engine node 16, the main-fuse node 17, the ABS node 18, the cowl right-side node 19, the rear left node 20, the rear right node 21, the front left node 22, the instrument panel node 23 and the cowl left-side node 24 correspond to a node 54 as shown in Fig. 4. The node 54 which is a high-speed operation control type includes a transceiver 51 connected to the high-speed communication line 11, an operation control unit 52 which comprises a microcomputer and which is connected to the transceiver 51, and an input-output processor 53 connected to the operation control unit 52. The input-output processor 53 is connected to an actuator 55 and a sensor 56, e.g., an ignition key sensor, which forms a signal.

[0026] The front right node 13, the column node 14, the meter node 15 and the engine node 16 connected to both the high-speed communication line 11 and the low-speed communication line 12 among the front right node 13, the column node 14, the meter node 15, the engine node 16, the main fuse node 17, the ABS node 18, the cowl right-side node 19, the rear left node 20, the rear right node 21, the front left node 22, the instrument panel node 23 and the cowl left-side node 24 correspond to both the low-speed operation control type node 48 as shown in Fig. 3 and the high-speed operation control type node 54 as shown in Fig. 4.

[0027] The control information in the multiplex transmission is transmitted through the high-speed communication line 11 and the low-speed communication line 12 in frame units. Fig. 5 illustrates the structure of the frame unit of the control information. In Fig. 5, the frame is an eighty-five bit code data which includes two-bit start marker SM, eight-bit data PRI indicating priorities, eight-bit data ID indicating information type, sixteen-bit data VLD indicating validity of the information, sixteen-bit data DT indicating the content of the information, eight-bit error correction data CRC, one-bit data end flag DE, twenty-four bit address designation data ANC and two-bit end marker EM.

[0028] At the low-speed non-operation control type node 43 as shown in Fig. 2, to which the center console node 25, the audio system node 26, the front left door node 27, the rear left door node 28, the front right door node 29, the rear right door node 30 and the tail node 31 respectively correspond, the transceiver 41 receives reception control information DQ having the frame structure as shown in Fig. 5 from the low-speed communication line 12, then obtains reproduced information DP by process such as demodulation and decoding to the reception control information DQ, and supplies the reproduced information DP to the input-output processor 42. The input-output processor 42 performs digital-analog (D/A) conversion of the reproduced information DP to generate a control signal SA and outputs the control signal SA via an amplifier (not shown) to the actuator 44. Thus the actuator 44 is controlled by the control signal SA.

[0029] At the low-speed non-operation control type node 43, the switch 45 is manipulated to supply a signal SB to the input-output processor 42. After amplification, the input-output processor 42 performs analog-digital (A/D) conversion to the signal SB to generate transmission information DR and supplies the transmission information DR to the transceiver 41. The transceiver 41 obtains transmission control information DS having the frame structure as shown in Fig. 5 by process such as coding and modulation and sends the transmission control information DS to the low-speed communication line 12.

[0030] On the other hand, in the low-speed operation control type node 48, to which the front left node 22, the instrument panel node 23, the cowl left-side node 24, the front right node 13, the column node 14, the meter node 15 and the engine node 16 correspond, the control unit 46 receives reception control information DV having the frame structure as shown in Fig. 5 from the low-speed communication line 12. The control unit 46 performs reproduction process to the reception control information DV such as demodulation and decoding and various operation processes to obtain operation process information DX.

[0031] The control unit 46 supplies the operation process information DX to the input-output processor 47, which performs D/A conversion to the operation process information DX to generate a control signal SA' and supples the control signal SA' via an amplifier (not shown) to the actuator 49. Thus the actuator 49 is controlled by the control signal SA'.

[0032] Further, in the low-speed operation control type node 48, a detected output signal SC from the sensor 50 is supplied to the input-output processor 47, which, after amplification, performs A/D conversion to the detected output signal SC to generate detected output information DY and supplies the detected output information DY to the control unit 46. The control unit 46 performs operation process based on the detected output information DY and other information, coding and modulation to the detected output information DY to obtain transmission control information DZ having the frame structure as shown in Fig. 5 and sends the transmission control information DZ to the low-speed communication line 12.

[0033] At the high-speed operation control type node 54 as shown in Fig. 4, to which the main-fuse node 17, the ABS node 18, the cowl right-side node 19, the rear left node 20, the rear right node 21, the front right node 13, the column node 14, the meter node 15 and the engine node 16 correspond, the transceiver 51 receives reception control information DV' having the frame structure as shown in Fig. 5 from the high-speed communication line 11. The transceiver 51 obtains reproduced information DU by process such as demodulation and decoding to the reception control information DV' and supplies the reproduced information DU to the operation control unit 52.

[0034] The operation control unit 52 obtains operation process information DX' by operation process based on the reproduced information DU and other information and supplies the operation process information DX' to the input-output processor 53. The input-output processor 53 performs D/A conversion to the operation process information DX' to generate a control signal SA" and supplies the control signal SA" via an amplifier (not shown) to the actuator 55. Thus the actuator 55 is operated by the control signal SA".

[0035] At the high-speed operation process type node 54, a detected output signal SC' from the sensor 55 is supplied to the input-output processor 53, which, after amplification, performs A/D conversion to the detected output signal SC' to generate detected output information DY' and supplies the detected output information DY' to the operation control unit 52. The operation control unit 52 obtains operation process output information DW by operation process based on the detected output information DY' and other information and supplies the operation process output information DW to the transceiver 51. The transceiver 51 performs process such as coding and demodulation to the operation process output information DW to obtain transmission control information DZ' having the frame structure as shown in Fig. 5 and supplies the transmission control information DZ' to the high-speed communication line 11.

[0036] The invention further comprises an additional node 60 and a connecting end portion 61, the explanation will be made with reference to Fig. 1.

[0037] In Fig. 1, the apparatus further comprises the additional node 60 which is connected to the low-speed communication line 12 and the connecting end portion 61 for connecting the additional node 60. The additional node 60 is connected to another additional control system as an actuator, and the node 60 corresponds to the low-speed non-operation control type node 43. When the additional node 60 is connected to the connecting end portion 61 and the additional control system is connected to the additional node 60, the incorporated control unit 46 in the cowl left-side node 24 which corresponds to the low-speed operation control type node 48 has function for processing operation required by the additional control system. In this manner, the additional control system can be appropriately controlled through the cowl left-side node 24 and the additional node 60.

[0038] In this case, the center console node 25, the audio system node 26, the front left door node 27, the rear left door node 28, the front right door node 29, the rear right door node 30 and the tail node 31 correspond to the low-speed non-operation control type node 43 as shown in Fig. 2, while the front right node 13, the column node 14, the meter node 15, the engine node 16, the main-fuse node 17, the ABS node 18, the cowl right-side node 19, the rear left node 20, the rear right node 21, the front left node 22, the instrument panel node 23 and the cowl left-side node 24 correspond to the low-speed operation control type node 48 as shown in Fig. 3 or the high-speed operation control type node 54 including the operation control unit 52 as shown in Fig. 4. Accordingly, wasteful part of the arrangement of the plurality of nodes can be deleted and efficiency of cost can be improved.

[0039] As many apparently widely different embodiments of the present invention can be made without departing from the scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

Claims

1. A multiplex transmission apparatus having:

a plurality of control nodes (13-31) connected, in a decentralized manner, to a common multiplex transmission path comprising multiplex transmission lines (11, 12) having a low-speed transmission path line (12) and a high-speed transmission path line (11),
said plurality of control nodes (13-31) including at least one control node of a first type (13-24) capable of performing an operation process and at least one control node of a second type (25-31) incapable of performing the operation process, the plurality of control nodes of said first type (13-24) being classified into:

nodes (22-24; 48) connected to the low-speed transmission path line (12),
nodes(17-21; 54) connected to the high-speed transmission path line (11) and
nodes (13-16; 48, 54) connected to both the low-speed transmission path line (12) and the high-speed transmission path line (11),
communication control means (41, 46, 51) located in each of said plurality of control nodes (13-31) for performing a communication function dependent upon the type of node; and operation process means (46, 52) located in said control node of said first type (13-24) performing a predetermined operation process,
wherein the communication control means (41, 46, 51) controls signal communication between the multiplex transmission lines (11, 12) and the operation process means (46, 52) and said operation process means (46, 52) performs an operation generating a first control signal (SA', SA") based on control information (DV, DVI) received from the multiplex transmission lines (11, 12) while said control node of said second type (25-31) generates a second control signal (SA) based on control information (DQ) received from the multiplex transmission lines (11, 12) without performing an operation process,
wherein a third control node (60) of said second type (25-31) is solely connected to only one path line of the low-speed and high-speed transmission path lines (11, 12) by a connecting end portion (61), and in that one control node (24) of the first type (13-24) is connected to said only one path line and has a function for processing operation required by said third control node (60).

2. The apparatus according to claim 1,
wherein the nodes (22-24; 48) connected to the low-speed transmission path line (12) comprise:

a single controller (46) to transmit control information (DZ) to and receive control information (DV) from the
low-speed transmission path line (12) and to perform a predetermined operation process; and
an input-output portion (47) to input and output a predetermined control signal.

3. The apparatus according to claim 1,
wherein the nodes (17-21; 54) connected to the high-speed transmission path line (11) comprise:

a transceiver (51) to transmit control information (DV') to and receive control information (DV') from the high-speed transmission path line (11) an input-output portion (53) to input and output a control signal; and
an operation controller (52) located between the transceiver (51) and said input-output portion (53) to perform a predetermined operation process.

4. The apparatus according to claim 1,
wherein said one control node (24) of the first type (13-24) and the third control node (60) are connected to the low-speed transmission path line.

5. The apparatus according to claim 1,
wherein there exist a plurality of control nodes of the plurality of control nodes (13-31) which are connected to both the low-speed and high-speed transmission path lines (11, 12).

6. The apparatus according to claim 1,
wherein said signals include at least information identification data (ID) and transmission information data (DT) flowing in said one path line of the low-speed and high-speed transmission path lines that connects the control node (24) and the third control nodes (60).

7. The apparatus according to claim 1,
wherein the third control node (60) has a coding or decoding capability.

8. The apparatus according to claim 1,
wherein the third control node (60) has a modulating or demodulating capability.

9. The apparatus according to claim 1,
wherein the third control node (60) has an A/D con-

verting or D/A converting capability.

Patentansprüche

1. Multiplex-Übertragungsvorrichtung mit:
einer Vielzahl von Steuerknoten (13-31), die in einer dezentralisierten Weise mit einem gemeinsamen Multiplex-Übertragungspfad verbunden sind, der Multiplex-Übertragungsleitungen (11, 12) mit einer Hochgeschwindigkeits-Übertragungspfadleitung (12) und einer Niedriggeschwindigkeits-Übertragungspfadleitung (11) aufweist, wobei die Vielzahl von Steuerknoten (13-31) zumindest einen Steuerknoten eines ersten Typs (13-24), der einen Betriebsprozeß durchführen kann, und zumindest einen Steuerknoten eines zweiten Typs (25-31), der den Betriebsprozeß nicht durchführen kann, aufweist, wobei die Vielzahl von Steuerknoten des ersten Typs (13-24) klassifiziert sind in:

Knoten (22-24; 48), die mit der Niedriggeschwindigkeits-Übertragungspfadleitung (12) verbunden sind,

Knoten (17-21; 54), die mit der Hochgeschwindigkeits-Übertragungspfadleitung (11) verbunden sind, und

Knoten (13-16; 48, 54), die mit sowohl der Niedriggeschwindigkeits-Übertragungspfadleitung (12) als auch der Hochgeschwindigkeits-Übertragungspfadleitung (11) verbunden sind,

einer Kommunikationssteuereinrichtung (41, 46, 51), die in jedem der Vielzahl von Steuerknoten (13-31) zum Durchführen einer Kommunikationsfunktion in Abhängigkeit von dem Typ des Knotens angeordnet ist; und einer Betriebsprozeßeinrichtung (46, 52), die in dem Steuerknoten des ersten Typs (13-24) zum Durchführen eines vorbestimmten Betriebsprozesses angeordnet ist,

wobei die Kommunikationssteuereinrichtung (41, 46, 51) eine Signalkommunikation zwischen den Multiplex-Übertragungsleitungen (11, 12) und der Betriebsprozeßeinrichtung (46, 52) steuert und die Betriebsprozeßeinrichtung (46, 52) einen Betrieb durchführt, der ein erstes Steuersignal (SA', SA") auf der Grundlage einer Steuerinformation (DV, DVI) erzeugt, die von den Multiplex-Übertragungsleitungen (11, 12) empfangen wird, während der Steuerknoten des zweiten Typs (25-31) ein zweites Steuersignal (SA) auf der Grundlage einer Steuerinformation (DQ) erzeugt, die von den Multiplex-Übertragungsleitungen (11, 12) ohne Durchführen eines Betriebsprozesses empfangen wird,

wobei ein dritter Steuerknoten (60) des zweiten Typs (25-31) ausschließlich mit nur einer Pfadleitung der Niedriggeschwindigkeits- und Hochgeschwindigkeits-Übertragungspfadleitungen (11, 12) durch einen Verbindungsendabschnitt (61) verbunden ist und in dem einen Steuerknoten (24) des ersten Typs (13-24) mit der nur einen Pfadleitung verbunden ist und eine Funktion zum Verarbeiten eines Betriebs aufweist, der durch den dritten Steuerknoten (60) erforderlich ist.

2. Vorrichtung nach Anspruch 1,
dadurch gekennzeichnet, daß die Knoten (22-24; 48), die mit der Niedriggeschwindigkeits-Übertragungspfadleitung (12) verbunden sind, aufweisen:

einen einzelnen Controller (46) zum Übertragen von Steuerinformation (DZ) zu der Niedriggeschwindkeits-Übertragungspfadleitung (12) und zum Empfangen von Steuerinformation (DV) von ihr, und zum Durchführen eines vorbestimmten Betriebsprozesses; und

einen Eingangs-Ausgangs-Abschnitt (47) zum Eingeben und Ausgeben eines vorbestimmten Steuersignals.

3. Vorrichtung nach Anspruch 1,
dadurch gekennzeichnet, daß die Knoten (17-21; 54), die mit der Hochgeschwindigkeits-Übertragungspfadleitung (11) verbunden sind, aufweisen:

einen Sendeempfänger (51) zum Übertragen einer Steuerinformation (DV') zu der Hochgeschwindigkeits-Übertragungspfadleitung (11) und zum Empfangen einer Steuerinformation (DV') von ihr, einen Eingangs-Ausgangs-Abschnitt (53) zum Eingeben und Ausgeben eines Steuersignals; und

einen Betriebscontroller (52), der zwischen dem Sendeempfänger (51) und dem Eingangs-Ausgangs-Abschnitt (53) angeordnet ist, zum Durchführen eines vorbestimmten Betriebsprozesses.

4. Vorrichtung nach Anspruch 1,
dadurch gekennzeichnet, daß ein Steuerknoten (24) des ersten Typs (13-24) und der dritte Steuerknoten (60) mit der Niedriggeschwindigkeits-Übertragungspfadleitung verbunden sind.

5. Vorrichtung nach Anspruch 1,
dadurch gekennzeichnet, daß eine Vielzahl von

Steuerknoten der Vielzahl von Steuerknoten (13-31) existieren, die mit sowohl den Niedriggeschwindigkeits- als auch den Hochgeschwindigkeits-Übertragungspfadleitungen (11, 12) verbunden sind.

6. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß Signale zumindest Informations-Identifikationsdaten (ID) und Übertragungsinformationsdaten (DT) aufweisen, die in der einen Pfadleitung der Niedriggeschwindigkeits- und der Hochgeschwindigkeits-Übertragungspfadleitungen fließen, die den Steuerknoten (24) und die dritten Steuerknoten (60) verbindet.

7. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der dritte Steuerknoten (60) eine Codierungs- oder Decodierungsfähigkeit aufweist.

8. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der dritte Steuerknoten (60) eine Modulations- oder Demodulationsfähigkeit aufweist.

9. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der dritte Steuerknoten (60) eine A/D-Umsetzungs- oder D/A-Umsetzungsfähigkeit aufweist.

Revendications

1. Appareil de transmission en multiplex ayant :

une pluralité de noeuds (13 à 31) de commande reliés, de manière décentralisée, à un trajet commun de transmission en multiplex comprenant des lignes (11, 12) de transmission en multiplex ayant une ligne (12) de trajet de transmission à faible vitesse et une ligne (11) de trajet de transmission à grande vitesse,
ladite pluralité de noeuds (13 à 31) de commande comprenant au moins un noeud (13 à 24) de commande d'un premier type capable d'effectuer une exécution d'opération et au moins un noeud de commande d'un second type (25 à 31) incapable d'effectuer l'exécution d'opération, la pluralité de noeuds (13 à 24) de commande dudit premier type étant classée en :

des noeuds (22 à 24 ; 48) reliés à la ligne (12) de trajet de transmission à faible vitesse,
des noeuds (17 à 21 ; 54) reliés à la ligne (11) de trajet de transmission à grande vitesse, et
des noeuds (13 à 16 ; 48, 54) reliés à la fois à ligne (12) de trajet de transmission à faible vitesse et à la ligne (11) de trajet de transmission à grande vitesse,
des moyens (41, 46, 51) de commande de communication situés dans chacun de ladite pluralité de noeuds (13 à 31) de commande pour effectuer une fonction de communication dépendant du type de noeud ; et
des moyens (46, 52) d'exécution d'opération situés dans lesdits noeuds (13 à 24) de commande dudit premier type effectuant un traitement prédéterminé d'opération,
dans lequel les moyens (41, 46, 51) de commande de communication commandent une communication de signaux entre les lignes (11, 12) de transmission en multiplex et les moyens (46, 52) d'exécution d'opération, et lesdits moyens (46, 52) d'exécution d'opération effectuent une opération produisant un premier signal (SA', SA") de commande basé sur des informations (DV, DV') reçues des lignes (11, 12) de transmission en multiplex, tandis que lesdits noeuds (25 à 31) de commande dudit deuxième type produisent un deuxième signal (SA) de commande basé sur des informations (DQ) de commande reçues des lignes (11, 12) de transmission en multiplex sans effectuer une exécution d'opération,

caractérisé en ce qu'un troisième noeud (60) de commande dudit deuxième type (25 à 31) est relié uniquement à seulement une ligne de trajet parmi les lignes (11, 12) de transmission en multiplex à faible vitesse et à grande vitesse par une portion (61) de raccordement d'extrémité, et en ce qu'un noeud (24) de commande du premier type (13 à 24) est relié à ladite seulement une ligne de trajet et a pour fonction de traiter une opération nécessitée par ledit troisième noeud (60) de commande.

2. Appareil selon la revendication 1, dans lequel les noeuds (22 à 24 ; 48) reliés à la ligne (12) de trajet de transmission à faible vitesse comprennent :

un dispositif unique (46) de commande pour émettre des informations (DZ) de commande et pour recevoir des informations (DV) de commande de la ligne (12) de trajet de transmission à faible vitesse et pour effectuer un traitement prédéterminé d'opération ; et
une portion (47) d'entrée-sortie pour recevoir et émettre un signal prédéterminé de commande.

3. Appareil selon la revendication 1,
dans lequel les noeuds (17 à 21 ; 54) reliés à la ligne (11) de trajet de transmission à grande vitesse comprennent :

un émetteur-récepteur (51) pour émettre des informations (DV') de commande et recevoir des informations (DV') de commande à destination et en provenance de la ligne (11) de trajet de transmission à grande vitesse ;
une portion (53) d'entrée-sortie pour recevoir et émettre un signal de commande ; et
un dispositif (52) de commande d'opération situé entre l'émetteur-récepteur (51) et ladite portion (53) d'entrée-sortie pour effectuer un traitement prédéterminé d'opération.

4. Appareil selon la revendication 1,
dans lequel ledit un noeud (24) de commande du premier type (13 à 24) et le troisième noeud (60) de commande sont reliés à la ligne (12) de trajet de transmission à faible vitesse.

5. Appareil selon la revendication 1,
dans lequel il existe une pluralité de noeuds de commande parmi la pluralité de noeuds (13 à 31) de commande qui sont reliés à la fois aux lignes (11, 12) de trajet de transmission à faible vitesse et à grande vitesse.

6. Appareil selon la revendication 1,
dans lequel lesdits signaux comprennent au moins des données (ID) d'identification d'informations et des données (DT) d'informations de transmission circulant dans ladite une ligne de trajet parmi les lignes de trajet de transmission à faible vitesse et à grande vitesse qui relie le noeud (24) de commande et le troisième noeud (60) de commande.

7. Appareil selon la revendication 1,
dans lequel le troisième noeud (60) de commande a une capacité de codage ou de décodage.

8. Appareil selon la revendication 1,
dans lequel le troisième noeud (60) de commande a une capacité de modulation ou de démodulation.

9. Appareil selon la revendication 1,
dans lequel le troisième noeud (60) de commande a une capacité de conversion analogique-numérique ou numérique-analogique.

FIG. 1

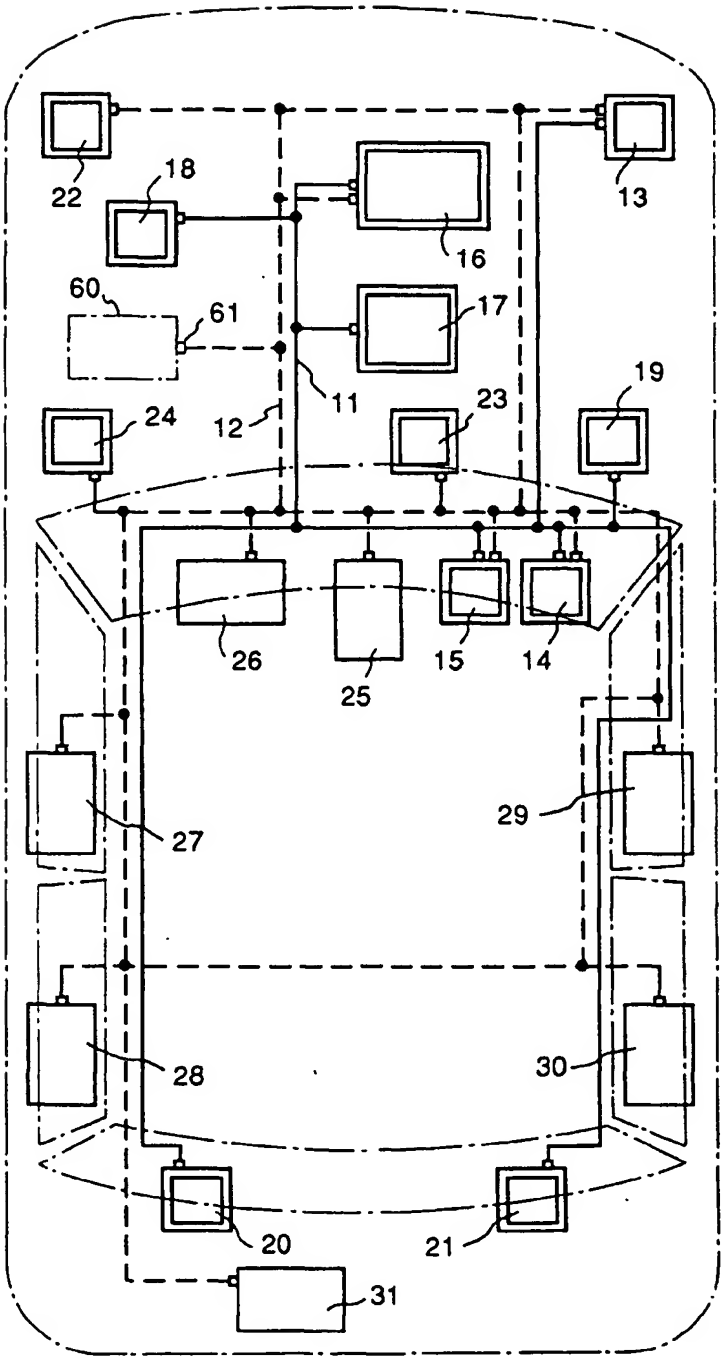


FIG. 2

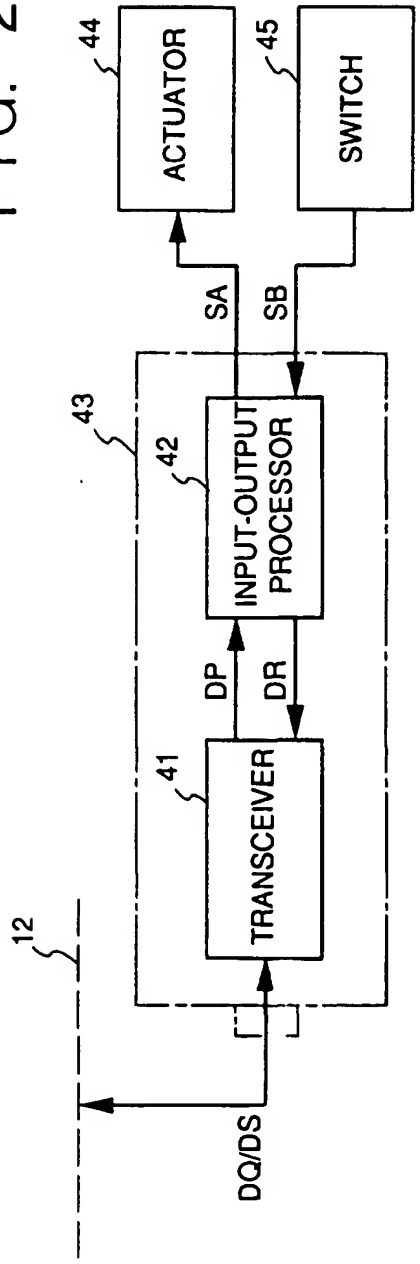

44
ACTUATOR
45
SWITCH
SA
SB
43
42
INPUT-OUTPUT PROCESSOR
DP
DR
41
TRANSCEIVER
12
DQ/DS

FIG. 3

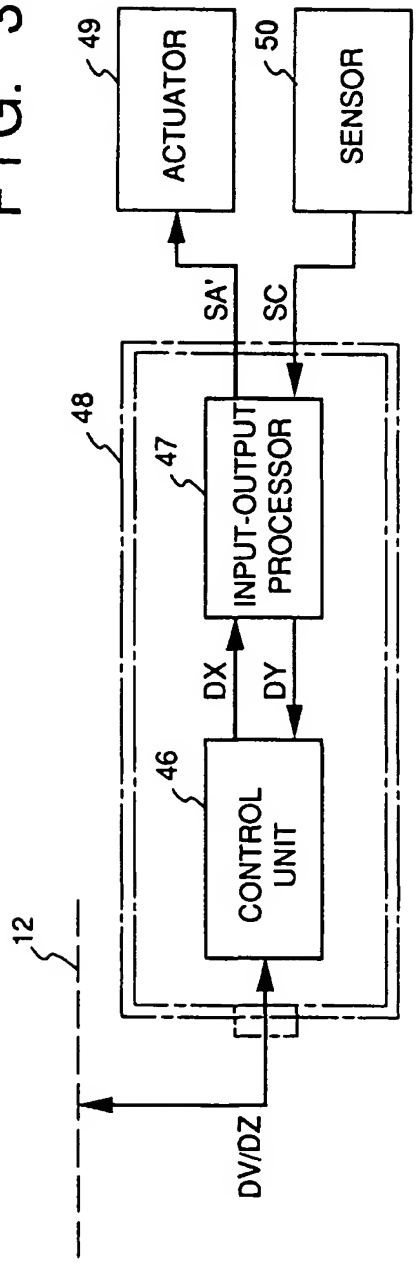

49
ACTUATOR
50
SENSOR
SA'
SC
48
47
INPUT-OUTPUT PROCESSOR
DX
DY
46
CONTROL UNIT
12
DV/DZ

FIG. 4

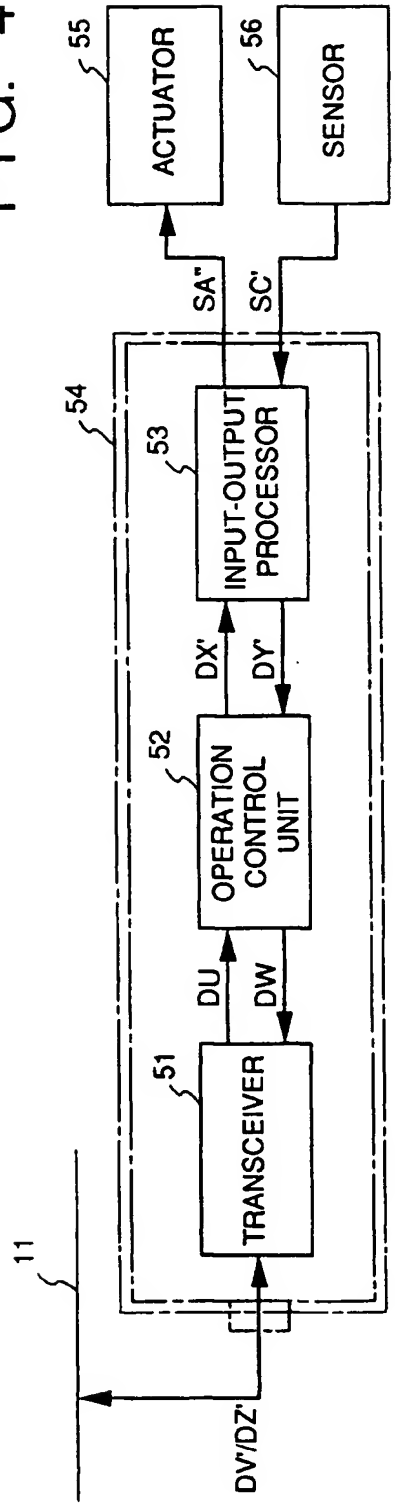
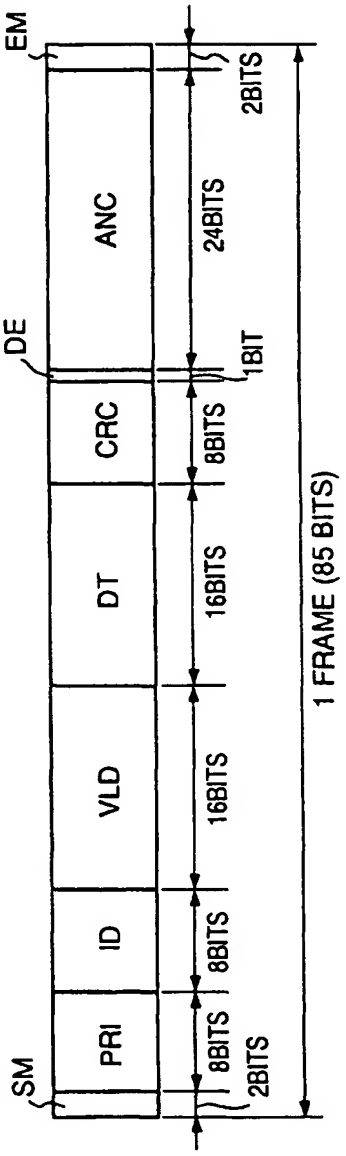

55
ACTUATOR
56
SENSOR
SA"
SC'
54
53
INPUT-OUTPUT PROCESSOR
DX'
DY'
52
OPERATION CONTROL UNIT
DU
DW
51
TRANSCEIVER
11
DV'/DZ'

FIG. 5


EM
ANC
DE
CRC
DT
VLD
ID
PRI
SM
24BITS
2BITS
1BIT
8BITS
16BITS
16BITS
8BITS
8BITS
2BITS
1 FRAME (85 BITS)